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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003905455 for a patent by JOSEPH DA CRUZ as filed on 03 October 2003.



WITNESS my hand this  
Sixth day of October 2004

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**A U S T R A L I A**

**Patents Act 1990**

**PROVISIONAL SPECIFICATION**

**for the invention entitled:**

**"Dental Appliance"**

## **DENTAL APPLIANCE**

### **Field of the Invention**

This invention relates to a dental appliance, and more particularly, but not exclusively, to a removable dental appliance for use in orthodontic correction, temporomandibular joint ("TMJ") splint therapy and/or myofunctional activities to alter muscle function and facial and dental development.

### **Background of the Invention**

Conventional removable dental appliances are located and retained on a wearer's jaw by use of clasps which fit firmly around a selected number of teeth. One form of clasp is known as an Adams' clasp, and, in general, fits tightly around a single tooth. It is usual for a conventional removable dental appliance to be anchored to the wearer's jaw by several such clasps so that the appliance is held firmly in place. However, such tight fitting of the dental appliance to the wearer's jaw often leads to the appliance being difficult to install, particularly if the wearer's teeth are tilted. Moreover, such conventional removable dental appliances often fit very tightly to the wearer's jaw, affecting movement of the wearer's skull bones causing discomfort and stress, both mentally and also physically (for example in the clenching of the wearer's face). The clasps used to hold the appliance in place by being anchored to particular teeth provide little or no freedom for the teeth to move. As such, the teeth are not able to make room for other teeth, and tooth extractions are commonly necessary.

The discomfort experienced by patients in wearing conventional removable dental appliances often makes the patient unwilling to wear the appliance, thus leading to a low level of compliance which has an adverse affect on the treatment which typically requires the appliance to be worn often and for extended periods. Further, if a patient does not wear the appliance for even just a few days, the teeth may move such that the appliance no longer fits properly. In such situations, it may be necessary for a new impression of the patient's jaw to be taken and for the appliance to be modified or replaced, which can be expensive and counter-

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productive in terms of achieving the desired effect for which the appliance is being used. Clasps such as Adams' clasps are also prone to breakage, particularly in situations where the appliance is difficult to install, and are also commonly incompatible for use with child patients who may not have sufficiently erupted teeth for the clasps to locate properly.

Preferred embodiments of the present invention seek to overcome or at least alleviate the above disadvantages of conventional removable dental appliances.

### **Summary of the Invention**

In accordance with one aspect of the present invention, there is provided a removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of the teeth, and wherein when in use the arch wire extends around an outer periphery of a set of the wearer's teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth.

Preferably, the arch wire extends from one side posterior portion of the base to the other side posterior portion of the base for contact with outer surfaces of the set of teeth along an outside of the arch.

Preferably, the dental appliance is for an upper jaw of the wearer.

Preferably, when the dental appliance is in use, the arch wire extends continuously from a left side posterior portion of the base, outwardly behind a posterior tooth on the left side of the arch, forwardly along the outside left side of the arch, rightward along the outside front side of the arch, rearwardly along the outside right side of the arch, and inwardly behind a posterior tooth on the right side of the arch to a right side posterior portion of the base.

Preferably, the arch wire incorporates a plurality of U-loops. In one embodiment, the arch wire incorporates four U-loops.

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Preferably, the dental appliance is provided with one or more expansion screws for enlarging a maxilla of the wearer. In one particular embodiment, the dental appliance is provided with a 3-way expansion screw mechanism for enlarging the maxilla of the wearer in left, right and anterior directions.

Preferably, the arch wire is provided with one or more C-clasps.

Preferably, the arch wire is provided with one or more L-rests.

Preferably, the base is acrylic. Preferably, the base is provided with a bite plane. In one embodiment the bite plane is an anterior bite plane. In an alternative embodiment the bite plane is a posterior bite plane.

In accordance with another aspect of the invention, there is provided a removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of a set of teeth on one side of the wearer's jaw, and wherein when in use the arch wire extends around an outer periphery of the set of teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth.

Preferably, the arch wire extends continuously from a posterior portion of the base, outwardly behind a posterior tooth of said set of teeth, forwardly in contact with outer surfaces of said set of teeth, and inwardly in front of a front tooth of said set of teeth to the base.

Preferably, the removable dental appliance is for a lower jaw of the wearer.

Preferably, the base has a first lingual portion and an opposed second lingual portion, the first and second lingual portions being held apart by a resilient member, the first lingual portion is contoured for contact with inner surfaces of a first set of teeth on one side of the wearer's jaw and the second lingual portion is contoured for contact with inner surfaces of a

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second set of teeth on an opposite side of the wearer's jaw, and when in use, a first arch wire extends continuously from a posterior portion of the first lingual portion, outwardly behind a posterior tooth of said first set of teeth, forwardly in contact with outer surfaces of said first set of teeth, and inwardly in front of a front tooth of said first set of teeth to the first lingual portion, and a second arch wire extends continuously from a posterior portion of the second lingual portion, outwardly behind a posterior tooth of said second set of teeth, forwardly in contact with outer surfaces of said second set of teeth, and inwardly in front of a front tooth of said second set of teeth to the second lingual portion.

Preferably, each of the first and second arch wires is provided with one or more C-clasps.

Preferably, the dental appliance has anterior wires or springs for urging forward anterior teeth of the wearer.

#### **Brief Description of the Drawings**

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an underside of a dental appliance for an upper jaw in accordance with a first embodiment of the present invention;

Figure 2 is a top perspective view of the dental appliance shown in Figure 1;

Figure 3 is a front perspective view of the dental appliance shown in Figures 1 and 2;

Figure 4 is a top view of a dental appliance for an upper jaw in accordance with a second embodiment of the present invention;

Figure 5 is a side perspective view of an underside of the dental appliance shown in

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Figure 4;

Figure 6 is a front perspective view of an underside of a dental appliance for an upper jaw in accordance with a third embodiment of the present invention;

Figure 7 is a plan view of an underside of the dental appliance shown in Figure 6;

Figure 8 is a top view of a dental appliance for a lower jaw in accordance with a fourth embodiment of the present invention;

Figure 9 is a front perspective view of the dental appliance shown in Figure 8; and

Figure 10 is a top view of the dental appliance shown in Figures 8 and 9.

#### **Detailed Description**

The removable dental appliance 10 shown in Figures 1 to 3 is for an upper jaw of a wearer and has an acrylic base 12 with a labial arch wire 14 coupled to the base 12. Figure 1 shows the dental appliance fitted to a model upper jaw. The base 12 of the dental appliance is shaped for being located inside of an arch 16 of teeth of the wearer in that the base 12 is formed with a curved upper portion 18 for resting against a roof of the wearer's mouth. An outer surface 20 of the base 12 is contoured for contact with inner surfaces of the wearer's teeth 17. The arch wire 14 extends from one side posterior portion 22 of the base 12 to the other side posterior portion 24 of the base 12 for contact with outer surfaces of the teeth 17 along an outside of the arch 16.

The base 12 may be formed from cold cured or heat cured denture acrylic, and may be trimmed or otherwise adjusted according to the pressure required to be applied to the teeth.

As can be seen in Figure 1, when the dental appliance 10 is in use, the arch wire 14 extends continuously from a left side posterior portion 24 of the base 12, outwardly (see

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reference numeral 25) behind a posterior tooth 26 on the left side of the arch 16, forwardly (see reference numeral 28) along the outside left side of the arch 16, rightward (see reference numeral 30) along the outside front side of the arch 16, rearwardly (see reference numeral 32) along the outside right side of the arch 16, and inwardly (see reference numeral 34) behind a posterior tooth 36 on the right side of the arch 16 to a right side posterior portion 22 of the base 12. The arch wire 14 also incorporates four U-loops 38 which may be adjusted to tailor the effect provided by use of the dental appliance 10. Although in other embodiments more than or less than four U-loops may be formed in the arch wire 14, the applicant has determined that four U-loops provides the arch wire 14 with an appropriate degree of flexibility whilst keeping good retention properties.

The dental appliance 10 shown in Figures 1 to 3 is also provided with a 3-way expansion screw mechanism 40 which has three expansion screws 42, 44, 46 for enlarging the maxilla of the wearer in left, right and anterior directions. Each of the expansion screws 42, 44, 46 is provided with apertures for receiving a tool (not shown) which is used by an orthodontist to adjust the effective size of the base 12 according to the shape desired in the wearer's maxilla. The base 12 is able to expand in response to adjustment of the expansion screws 42, 44, 46 by virtue of breaks 47 formed in the base 12 which divide it into three separate panels 48, 50, 52. The effect provided by the expansion screws 42, 44, 46 in this arrangement is advantageous as the arch wire 14 is around the arch 16 and there is nothing grabbing or hurting the teeth 17 as is often the case with conventional previously proposed dental appliances. As such, the present arrangement provides benefits in influencing the nervous system and muscle function of the wearer.

The base 12 has an anterior bite plane 53 which may be formed so as to be either flat or sloped in order to bring the wearer's lower jaw forward when the lower jaw is occluding the bite plane 53 and to relax the wearer's chin and neck muscles. The acrylic base 12 is formed according to the shape desired to be given to in the wearer's jaw. The anterior bite plane helps to put the wearer's teeth together so that there is no deep bite and the right amount of bottom teeth are showing. Over time, a deep bite is able to be corrected and clenching is able to be reduced through the use of an anterior bite plane which operates as a clenching inhibitor.



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Further, the effect of the bite plane and the widening of the maxilla may help to relieve TMJ problems and may help to encourage opening of the mouth of a wearer previously suffering a jaw opening restriction. Posterior bite planes can also be used instead of anterior bite planes, for example in the case of Class III malocclusions, especially in children.

A C-clasp 54 is soldered onto each side of the arch wire 14 to assist retention of the dental appliance 10 to the wearer's teeth 17. Each side of the arch wire 14 is also provided with an L-rest 56 for preventing the arch wire 14 from dropping.

The dental appliances 10 shown in Figures 4, 5 and 6, 7 are similar in many respects to the dental appliance 10 shown in Figures 1 to 3, and like features are indicated by like reference numerals. The dental appliance shown in Figures 4 and 5 does differ however in that it has changed, more asymmetric, geometry to suit a specific case of patient, a 1-way expansion screw mechanism 58 (and correspondingly only one break 47 in the base 12 required for size adjustment of the base 12), and the arch wire 14 having only two U-loops 38. The dental appliance 10 shown in Figures 6 and 7 also has accentuated asymmetric geometry, and a 1-way expansion screw mechanism 58, but has six U-loops 38 incorporated into the arch wire 14.

Dental appliances made according to preferred embodiments of the present invention, in particular by virtue of the arrangement of the arch wire, allow smooth fitting of the appliance while still providing adequate pressure on teeth to be moved.

The removable dental appliance 60 shown in Figures 8, 9 and 10 is for a lower jaw of a wearer, and is shown in Figures 8 and 9 as being fitted to a model of a lower jaw. The dental appliance 60 has a base 62 which is formed of a first lingual portion 64, a second lingual portion 66 and a resilient member 68 in the form of a kind of W-type coffin spring. The first and second lingual portions 66, 68 are held apart by the resilient member 68 which may be adjusted to widen the wearer's mandible, particularly in cases where the wearer also has fitted a dental appliance on his or her upper jaw and it is necessary to widen the mandible to keep up with a widening of the maxilla. The first lingual portion 64 is contoured for contact with inner surfaces of a first set 70 of teeth on one side of the wearer's lower jaw, and the second lingual portion 66 is

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contoured for contact with inner surfaces of a second set 72 of teeth on an opposite side of the wearer's lower jaw. As is shown in Figure 8, when in use a first arch wire 74 extends continuously from a posterior portion 76 of the first lingual portion 64, outwardly (see reference numeral 78) behind a posterior tooth 80 of said first set 70 of teeth, forwardly (see reference numeral 82) in contact with outer surfaces of said first set 70 of teeth, and inwardly (see reference numeral 84) in front of a front tooth 86 of said first set 70 of teeth to the first lingual portion 64. Similarly, a second arch wire 88 extends continuously from a posterior portion 90 of the second lingual portion 66, outwardly (see reference numeral 92) behind a posterior tooth 94 of said second set 72 of teeth, forwardly (see reference numeral 96) in contact with outer surfaces of said second set 72 of teeth, and inwardly (see reference numeral 98) in front of a front tooth 100 of said second set 72 of teeth to the second lingual portion 66. Preferably, each of the first and second sets of teeth 70, 72 includes teeth from premolar to molars.

Each of the first and second arch wires 74, 88 is provided with two C-clasps 102, soldered to the respective arch wire 74, 88 to assist retention of the dental appliance 60 to the wearer's lower jaw. The dental appliance 60 is also provided with anterior wires or springs 104 for urging forward anterior teeth 106 of the wearer.

The base 62 may be trimmed or otherwise adjusted according to the pressure required to be applied to the teeth.

Dental appliances in accordance with preferred embodiments of the present invention facilitate easy installation to a wearer's jaw or jaws, and are more comfortable compared to conventional previously proposed dental appliances, affording the teeth greater freedom to move. Further, as the arches are able to be widened by use of the present appliance, the need for extractions is reduced. The arrangement of clasp and arch wire can be used in a greater variety of situations when compared to previously proposed appliances, and even in cases previously of low retention. Retention may be improved by widening the base by adjusting the expansion screw and by trimming the acrylic so that pressure is applied to teeth that need to be moved outward. The pressure should be gentle and slow, and the widening allows the teeth to be realigned with greater freedom. Such realignment can be directed by the arch wire and by

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auxiliary wires or springs either soldered to the arch wire or fixed into the acrylic.

Due to the way the acrylic is on the inside and the arch wire is on the outside, teeth can move in 6 directions to achieve harmony. That is forwards and backwards, side to side and up and down.

Dental appliances according to preferred embodiments of the present invention may be used in the following applications:

- In the treatment of simple and some complex orthodontic cases, especially for young children before the use of braces. In some cases braces can be totally avoided.
- In the treatment of TMJ with relief of headaches and tension, allowing greater improvement in jaw opening.
- In the treatment of clenching and squeezing the face to allow changes in the shape of the face, and in some cases changing patterns of mouth breathing by widening the maxilla as early as is possible.
- As a splint to give relief in clenching patterns.
- For tightening up the upper lip and loosening the chin and neck muscles.
- For the treatment of sleep apnoea and bed wetting or difficult sleeping.
- In the treatment of asthma for improved breathing.
- As an active or passive TMJ appliance to alter muscle forces, to alter growth and guide dental development, muscle function and correct bad habits.
- As a general retainer to refine and maintain and even complete orthodontic treatment after the braces are removed.
- To help to correct asymmetrical jaws to some degree and angulation of the smile line (cant), due to uneven muscle contraction of the face.
- In helping to shrink tonsils and adenoids, and improve breathing.
- In the treatment of migraines, headaches, neck problems, RSI, backaches and leg pain.

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This system can also be used for people that have missed out on braces or find braces too expensive, which gives another alternative to fix malocclusion and TMJ problems in a simple easy manner.

The preferred embodiments have been described by way of example only and modifications are possible within the scope of the invention. Although not shown in the representations, in other embodiments in accordance with the invention, the dental appliance for either the upper or lower jaw may be provided with springs (for example by soldering Z-springs to the arch wire) for tailoring movement of the wearer's teeth. Other features, may also be added onto the arch wire or base as required to move teeth as necessary. Lip bumpers may also be added.

Composite filling material can be added onto teeth which helps to position the arch wire and also move teeth, like eye teeth either labially or lingually. It can be added onto baby teeth to give greater undercut for retention purposes. Z springs can engage a little composite filling material bonded to a tooth just above the spring to prevent the appliance from being unstable and coming out of the mouth. Springs etc. can be added to the arch wire by using metal bonding and resin without soldering.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that that prior art forms part of the common general knowledge in Australia.

DATED this 3rd day of October, 2003

**Joseph DA CRUZ**

By his Patent Attorneys:

**DAVIES COLLISON CAVE**

### **ABSTRACT**

A removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of the teeth, and wherein when in use the arch wire extends around an outer periphery of a set of the wearer's teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth.

A removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of a set of teeth on one side of the wearer's jaw, and wherein when in use the arch wire extends around an outer periphery of the set of teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth.

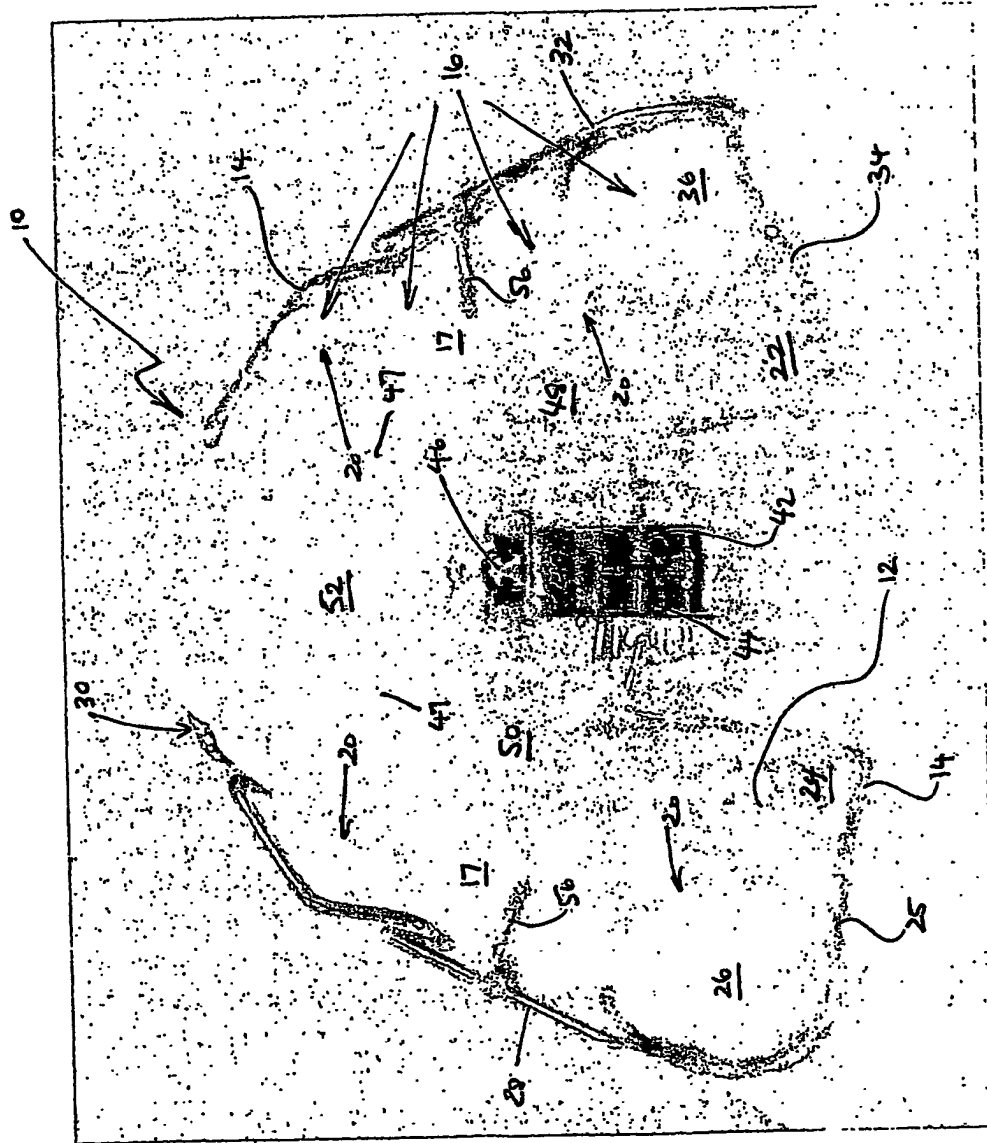


Figure 1

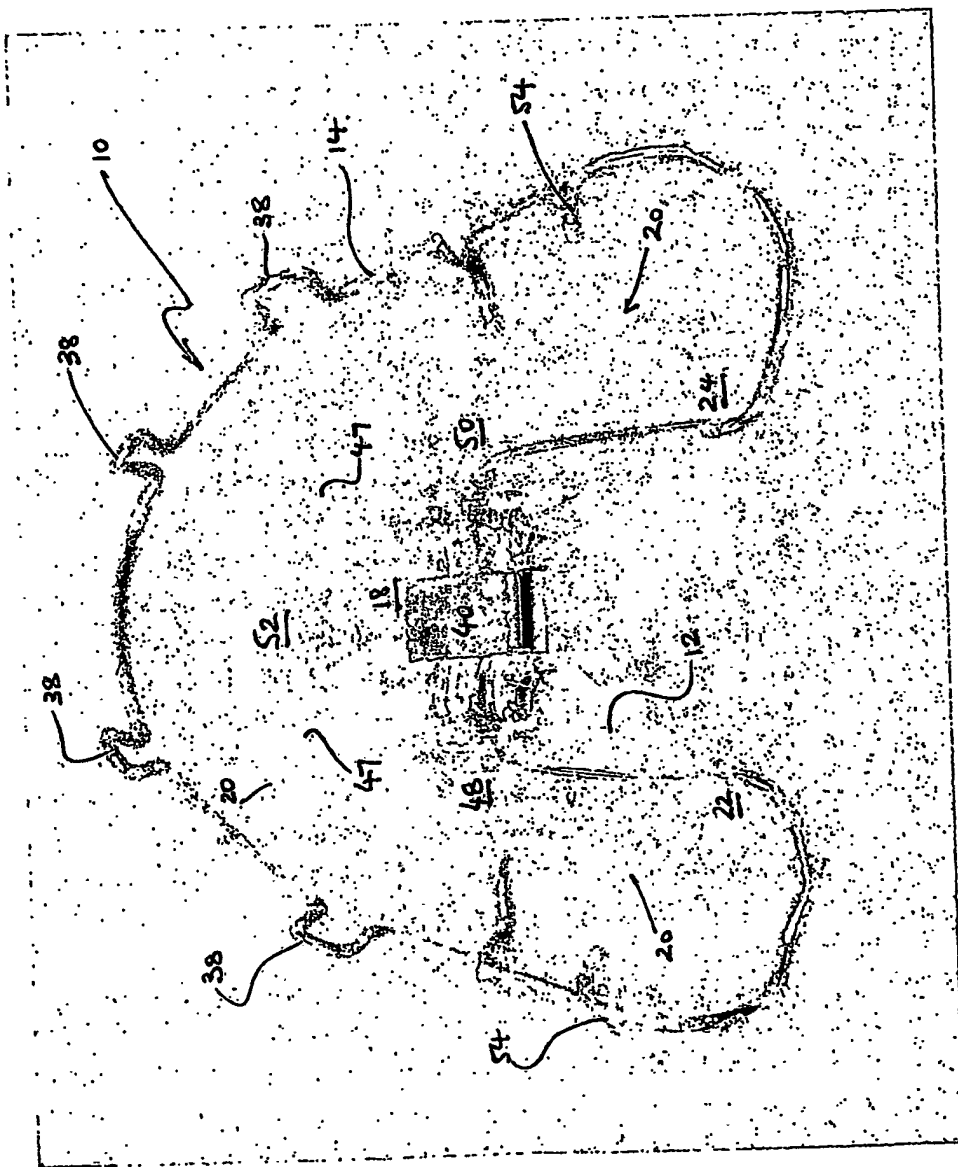


Figure 2

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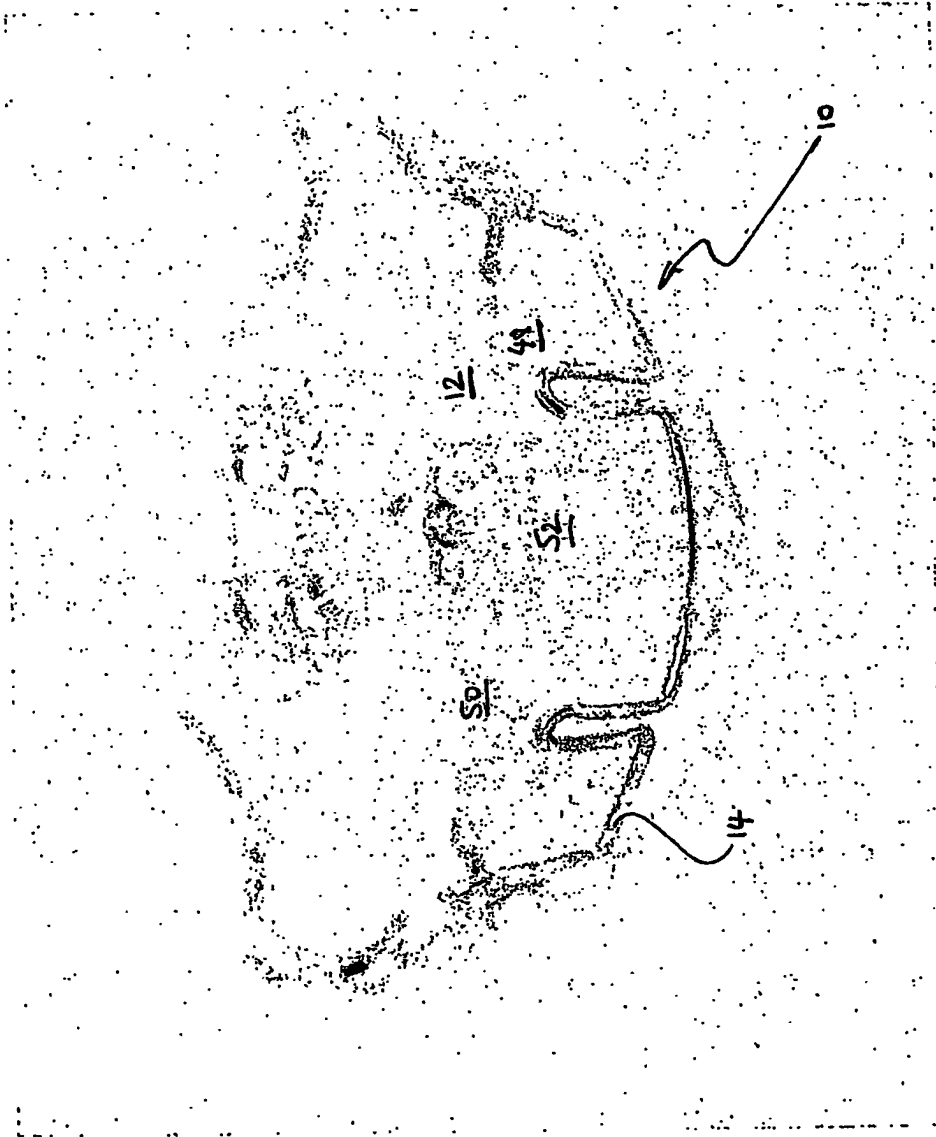


Figure 3



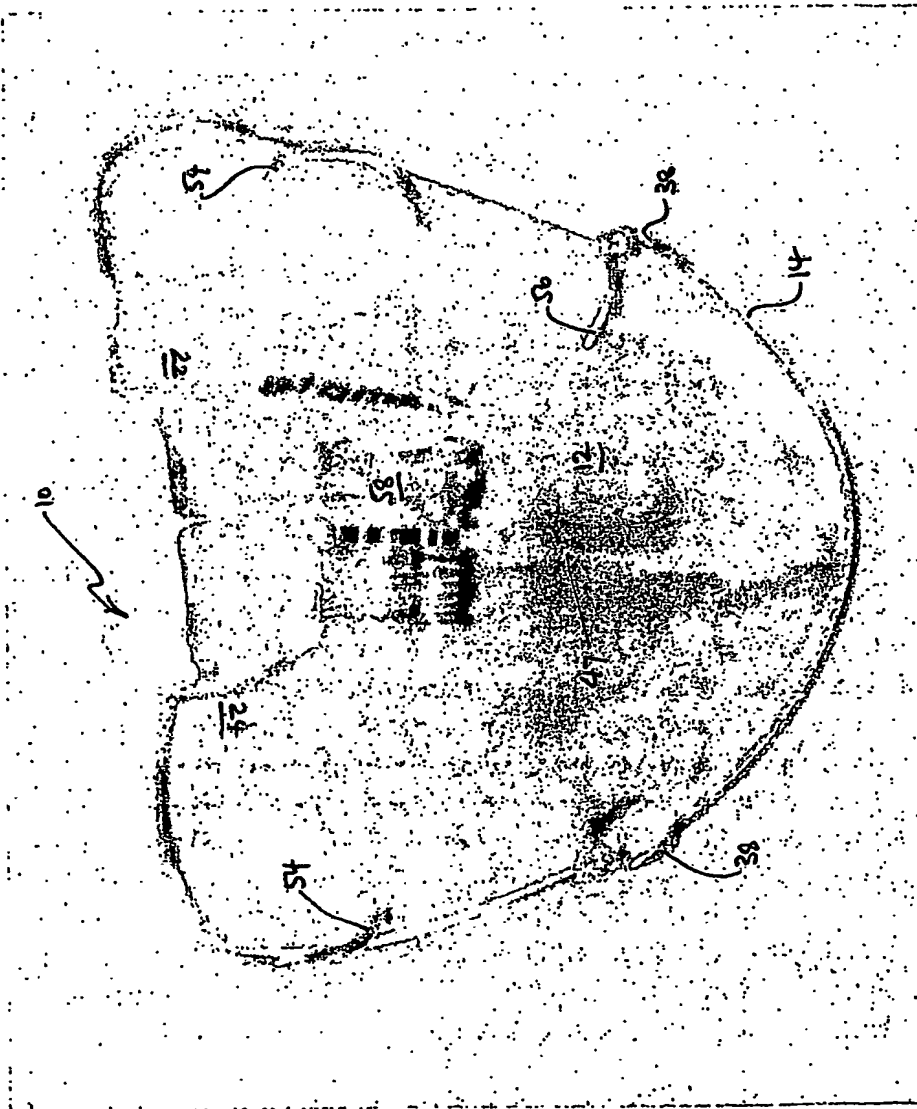


Figure 4

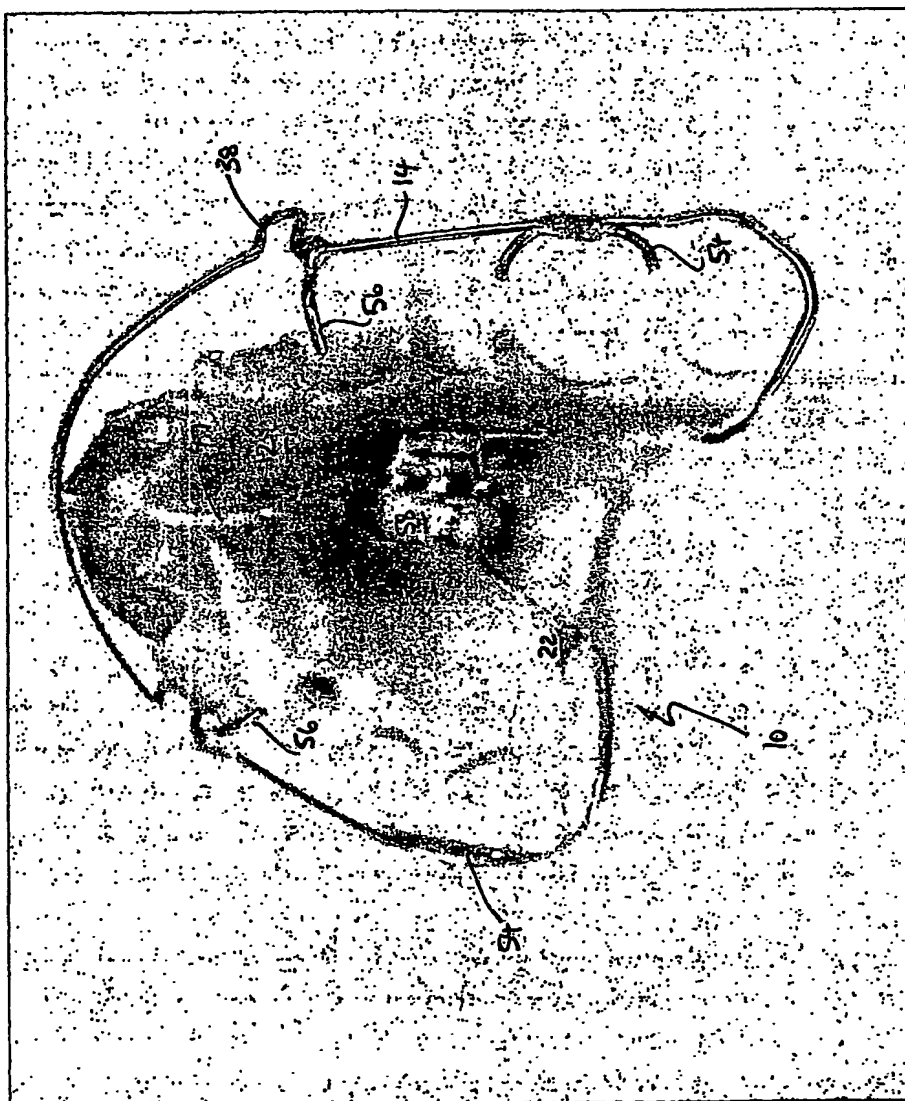


Figure 5

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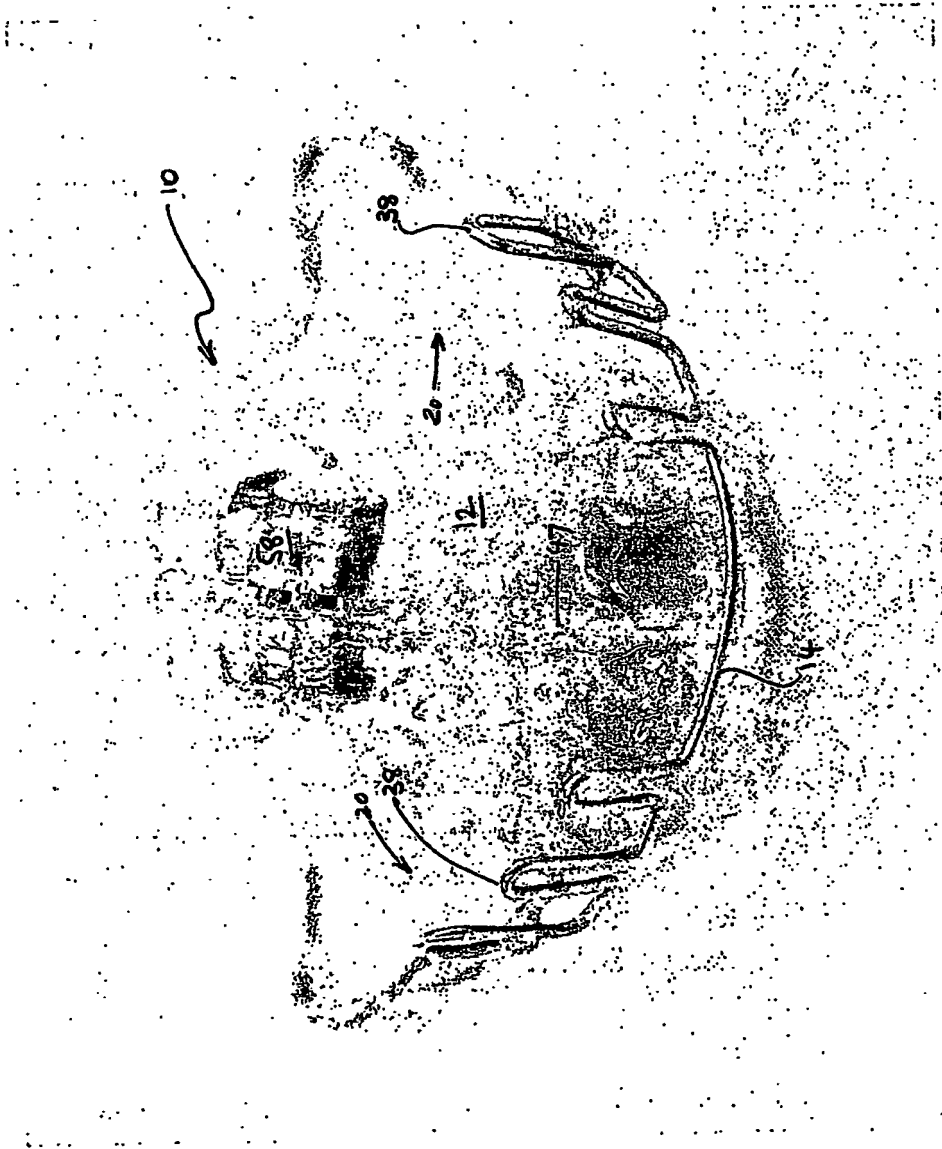


Figure 6

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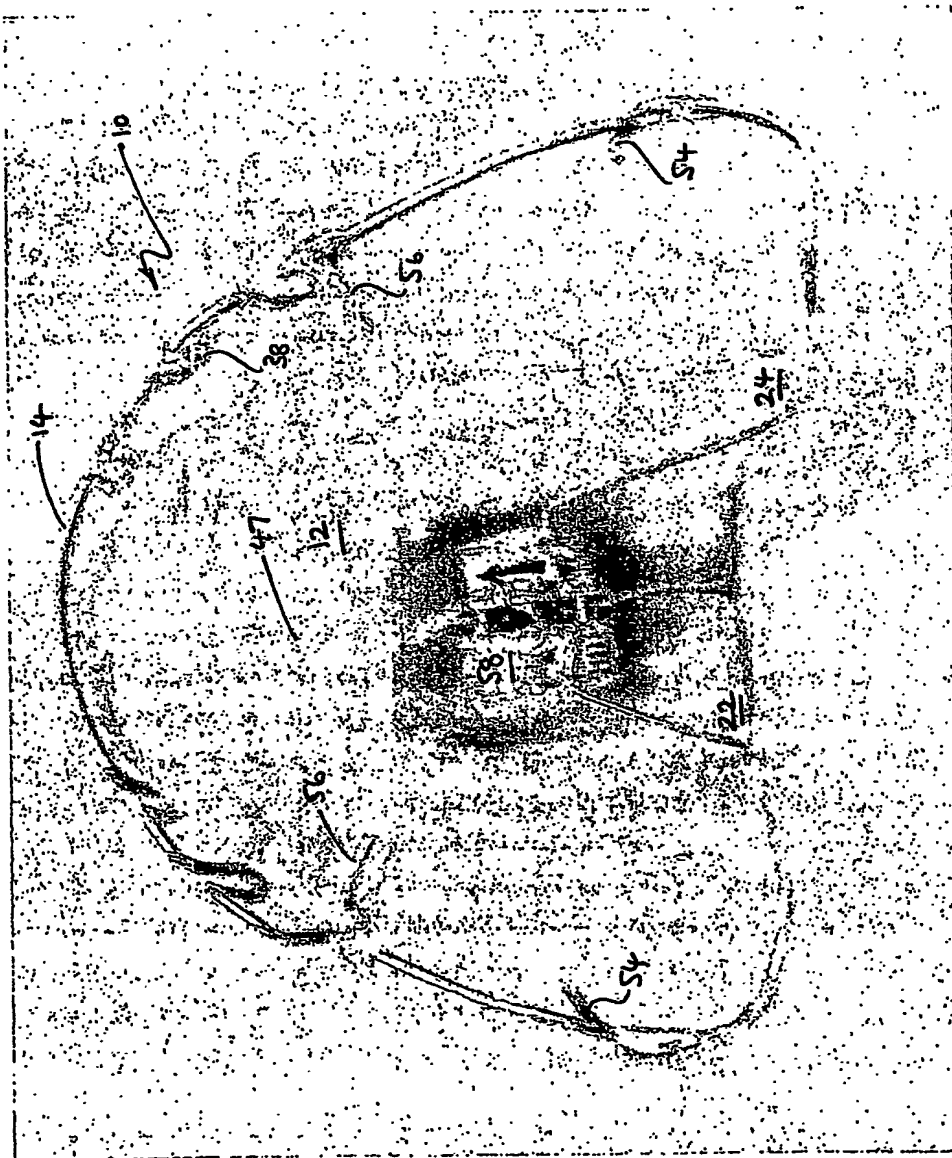


Figure 7

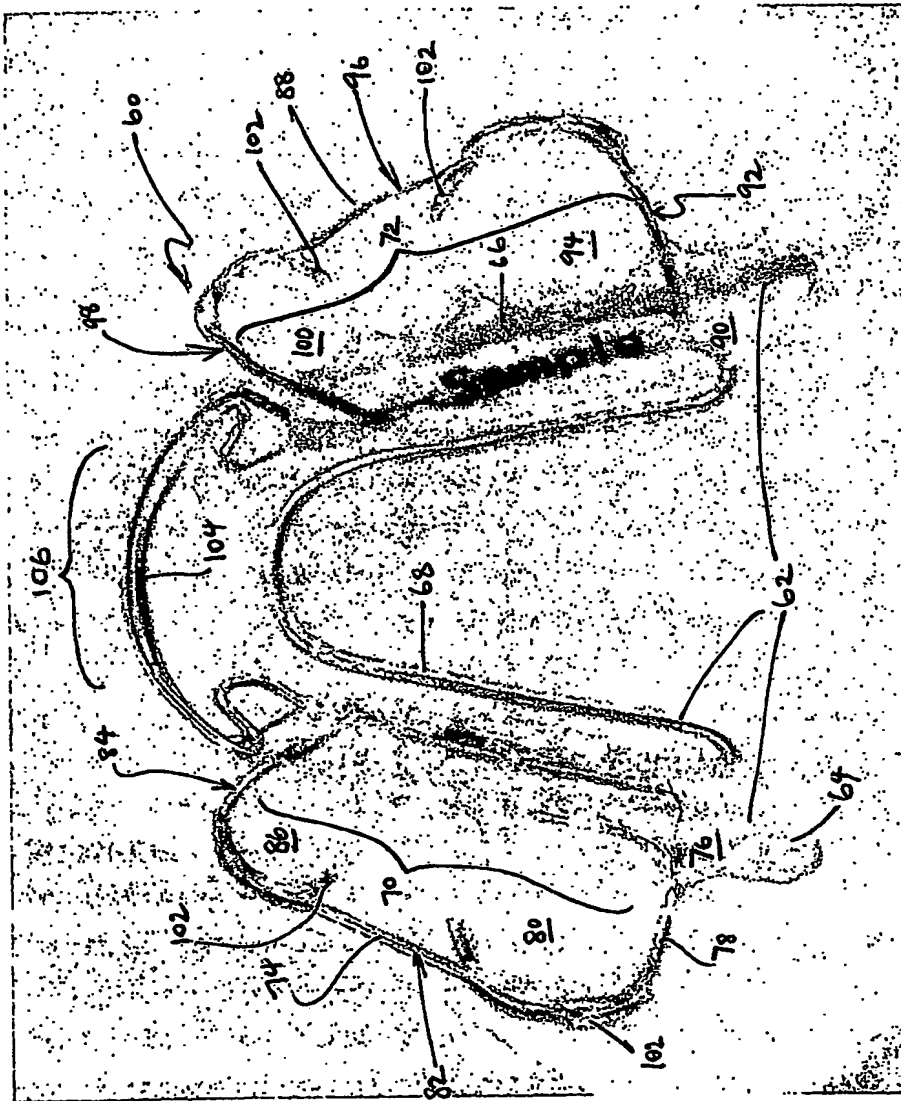


Figure 8

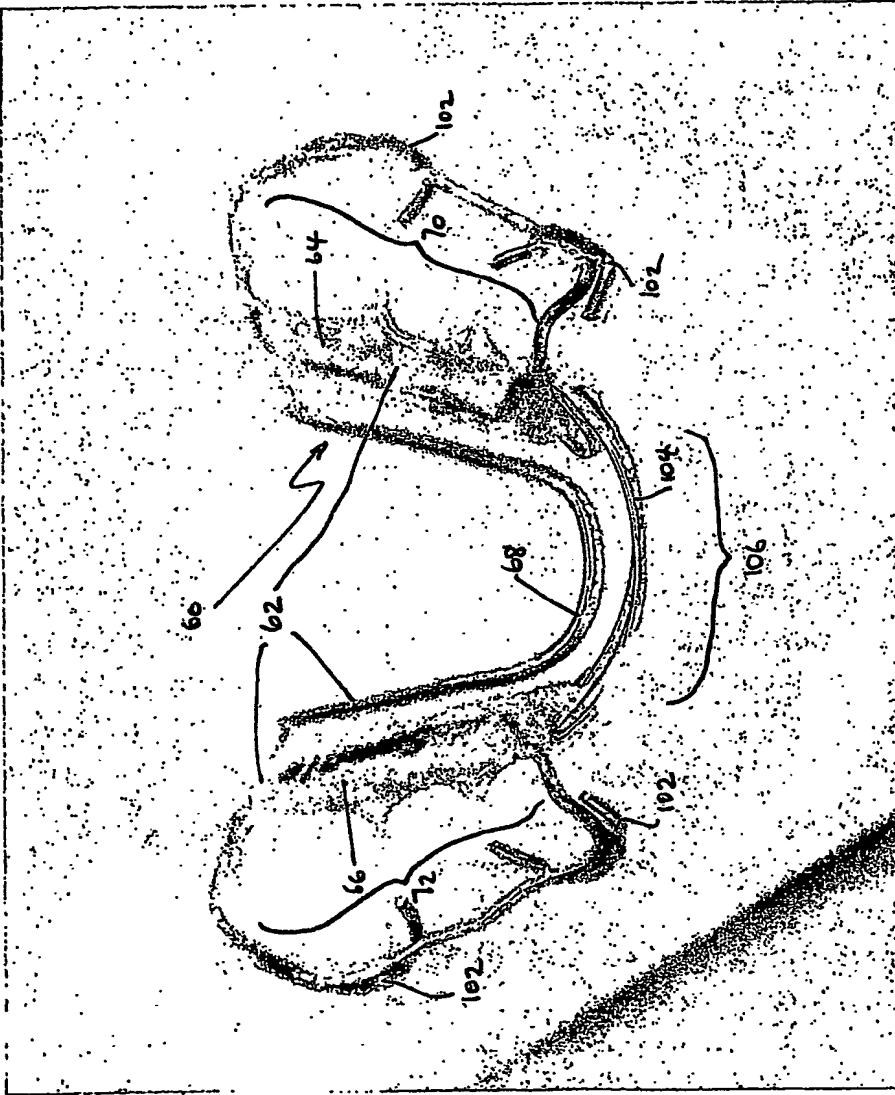


Figure 9

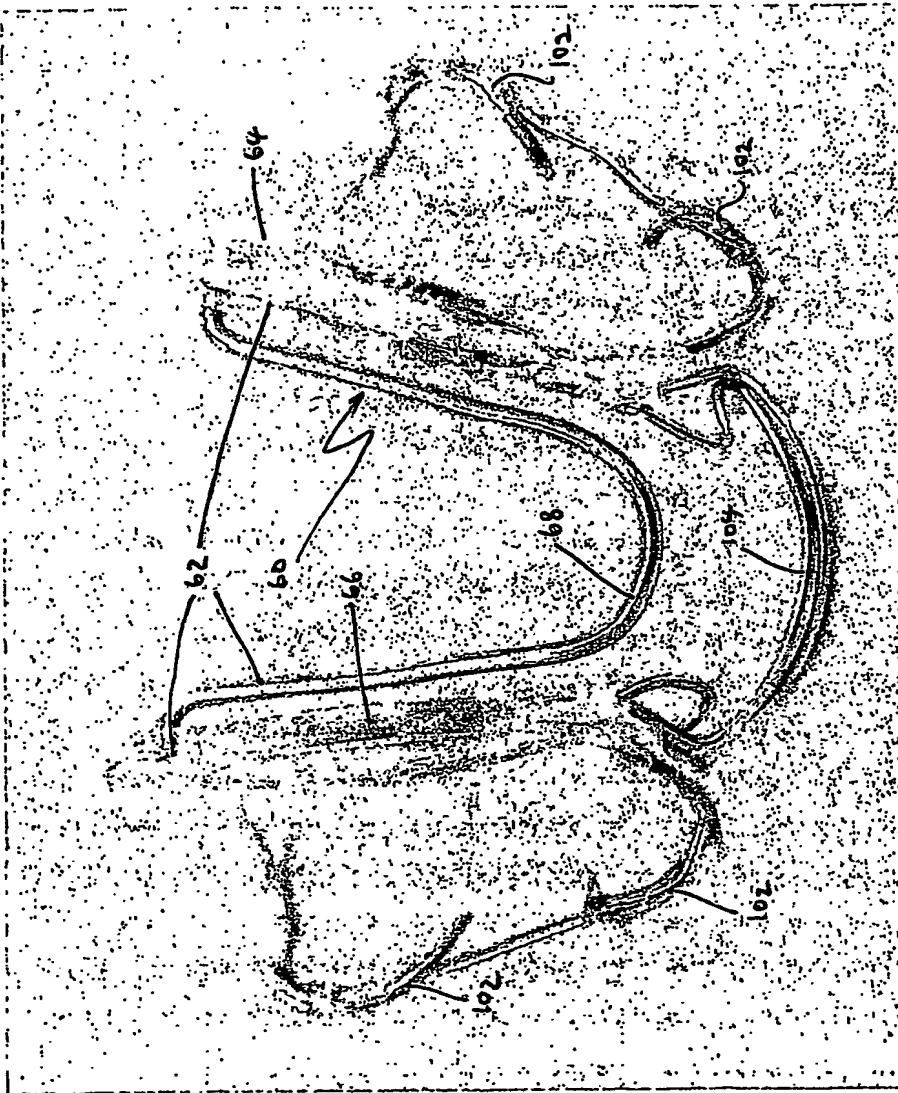


Figure 10

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